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27 June 1966

MEMORANDUM FOR THE RECORD

SUBJECT: Project Report of South Viet Nam Secure Voice Study

1. A study was undertaken in early 1966 to determine the feasibility of establishing with standard off-the-shelf radio equipment a Class A secure voice communications network in South Viet Nam. The proposed network would link eight major cities (see attachment) in South Viet Nam. The purpose of this report is to describe certain salient considerations which are involved in selecting a mode of transmission which would satisfy the above requirement in the most reliable and economical manner. Fulfilling the requirement through the use of existing military facilities is not covered in this report.

2. NSA and our R&D Lab have already proven the feasibility of using standard commercially available VHF-FM radio equipment with the KY/8 for secure voice transmission over a limited range of distances. The actual coverage, of course, is dependent upon the effective radiated power of the system and the nature of intervening terrain between terminals. Normally distances of forty miles are typical for 100 watt base station units and low gain antennas. Since the VHF-FM mode of transmission is fairly inexpensive and simple, considerable effort was devoted to determine if a system consisting of standard mobile base station type units (transmitter and receiver) could be configured or arranged to satisfy the basic requirement. A General Electric 80 watt base station unit costs about $1,330 and their 330 watt base unit costs about $2,550.

3. Distances between adjacent cities (see attachment) vary between thirty-six miles (shortest) to one hundred and forty-six miles (longest). The topography between the designated eight cities was studied in detail and path profiles of the earth's contour between adjacent cities were made where it was deemed necessary. Due to the curvature of the earth alone, 200-foot towers would be required at each end of a forty mile path for a grazing line-of-site condition. Examination of the profiles reveals that only two of the possible eight paths are not obstructed by mountainous terrain. These two paths which are over swampland are Can Tho to My Tho and My Tho to Saigon. The extra propagation loss in the obstructed paths make successful transmission in the 132-174 mcs band difficult. The highest

GROUP 1 Excluded from automatic

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powered transmitter offered by Motorola (375 watts) coupled into a high gain antenna system (13 db above an isotropic radiator) will still not be able to offset the high obstruction losses. Additional antenna gain is available in the 406-470 mcs band but is offset by an increase in free space path loss and in obstruction loss and a decrease in available transmitter power.

4. The radio transmission group at the [redacted] 25X1A5a1 facility was given four pertinent path profiles and 25X1A5a1 was requested to calculate the reliability for each path based on standard 150 mcs base station equipped with 1 KW amplifiers and 19 db antennas (quad array of 13 db yagis). The results of their study indicate that a reliability better than 99 percent throughout the year would exist for the Pleiku to Dan Me Thuat path and the Dan Me Thaut to Dalat path if the forementioned special equipment were used. However, satisfactory performance over the remaining paths is not feasible with the specified equipment limitations. Therefore, in view of the above factors, transmission in either of the 132-174 or 406-470 mcs band is not considered a likely means to fully satisfy the original requirement.

5. Remaining commercial base station units which would also be compatible with the KY/8 fall into two frequency bands, 25-54 mcs and 66-88 mcs. The 25-54 mcs band is highly undesirable for the following reasons. Prevailing multipath conditions resulting from erratic ionospheric support present for frequencies in the 25-54 mcs band would severely distort the high speed digital signal (18.75 kbs). A second serious disadvantage is that the ambient noise level in the 25-54 mcs band is rather high (in the order of 10 microvolts). Propagation in the 66-88 mcs band would not be greatly different than that in the 132-174 mcs band.

6. Two remaining possible modes of transmission are tropo scatter or HF radio. The cost (over $150K) and size of a typical tropo scatter radio system designed to be compatible with the KY/8 make this mode highly impractical. HF transmission in the 2-14 mcs band is feasible but would require a complex layout of equipment. For instance, the KY/8 would be replaced by a HY/2-vocoder, HN-9A-interface unit, and the KG-13 crypto unit. The transmitting portion would consist of a high speed data modem, an exciter, a linear amplifier (1 KW minimum) and an extremely high radiation angle transmitting antenna. Diversity reception and automatic frequency control receiving units are mandatory for HF hi-speed data circuits. Since the

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PNA-6A antenna is not effective for distances under 500 miles, two receiving half wave dipoles are necessary unless frequency diversity is to be employed. The equipment cost for one HF secure voice circuit would be about $120K. In addition to the high cost and equipment complexity reliable HF propagation for paths between 50 to 500 miles is notoriously more difficult to maintain than for longer paths.

7. In conclusion it is evident that there is no simple and clear method for satisfying the original requirement. The VHF-FM/KY-8 mode for transmission is relatively simple and inexpensive but can not be expected to provide reliable service over most of the obstructed paths. A tropo scatter system would be impractical due to its high cost and large size. Although the HF mode of transmission can probably satisfy the requirement the resulting system would be rather large, complex, and expensive. Based on the findings of this report no attractive solution is available. In view of the preceding statement, it is recommended that a conference be held to determine a future course of action. Possibly the use of installed military facilities should be considered.

[redacted]

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Attachment:
Proposed Secure Voice Network
South Viet Nam

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